Operating Instructions Dräger FG4200

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1. Information

1.1 Certification

The Dräger FG4200 flue gas measurement device is tested according to the requirements of the European standard EN 50379 Parts 1 and 3.

1.2 Usage

The Dräger FG4200 flue gas measurement device is suitable for measuring combustion parameters of heating systems. It is not suitable for use as a continuously operating gas warning and alarm device.

Any use of this device requires full understanding and compliance with these operating instructions, the relevant standards, as well as the relevant statutory regulations.

The device is intended only for the uses described in this manual. Any improper use of the device may lead to electric shock or destruction of the measuring device!

Always fully charge the Dräger FG4200 via the USB interface with a 5 V DC / 1 A USB power supply adapter only.
Incomplete charging affects the charging capacity of the battery in the long term.
When charging, no measurements should be performed.

The displays shown in this manual are examples.
Only recorded measurements can be printed or saved.

The device employs fuel-specific formulas to calculate CO_2 and qA (flue gas loss) combustion parameters. For this reason, these combustion parameters can only be calculated for the fuels which are saved in the fuel table of the device. The following fuels can be set: Light fuel oil, natural gas, LPG propane, heavy fuel oil, pellets, wood, brown coal, hard coal, coal briquettes, coal coke, anthracite, biogas, LPG butane, coal gas, coke oven gas.

The lifetime of the sensors used in the Dräger FG4200 is typically 4 years for both the O2 sensor and the CO sensor. The pressure sensor has no limited lifetime under normal-use conditions.

To avoid influencing the measuring accuracy of the sensors, the Dräger FG4200 must not be exposed to solvents, fuels or plasticizers during operation and storage.

1.3 Maintenance

To ensure proper function and accuracy, calibration and adjustment should be performed once a year. Device maintenance must only be carried out by trained service personal.

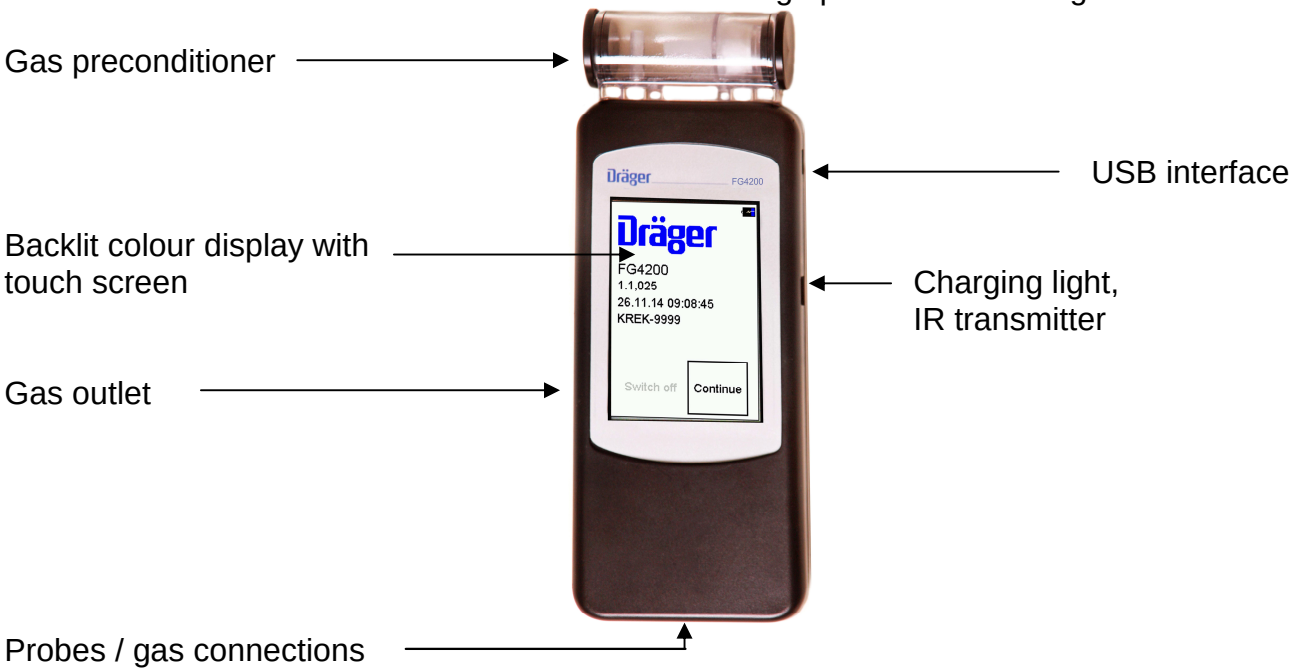
1.4 Disposal according to WEEE

Since 2005, EU-wide regulations apply to the disposal of electrical and electronic devices. In essence, these regulations set out that collection and recycling options should be available for households. Because the Dräger FG4200 is not registered for use in private households, it must not be disposed of through such channels. The devices can be returned to your national retailer or to your national Dräger Safety Organization for disposal. Please contact Dräger MSI GmbH, if you have any questions regarding disposal.

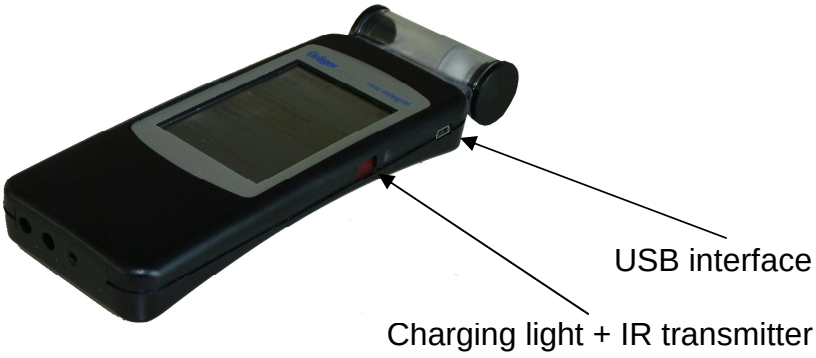
2. The measuring device

The Dräger FG4200 is an all-purpose, electronic multi-channel device for calibration and testing work on small and medium-sized combustion systems.

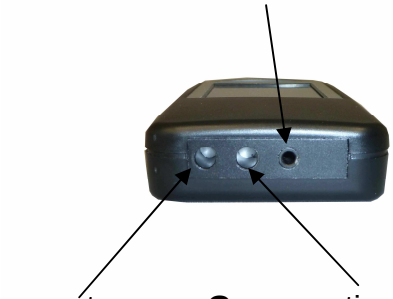
All tests and measurements can be documented through print outs or storage.



Connections



T connection for the temperature gauge of the flue gas probe



P connection for draft measurement

G connection for flue gas measurement

3. First time use and general operation

3.1 Preparation for first time use

Before using the measuring device, the integrity of all components must be checked, e.g.:

- Device exhibits no visible damage
- No condensed water in the gas preconditioner
- The gas preconditioner filter is clean
- Gas hoses without defects
- Visual inspection of the probe

Connect the quick-release hose coupling of the flue gas probe into the gas inlet **G** of the measuring device and the jack plug of the flue gas probe in the temperature input **T** of the measuring device. Ensure before each measurement that a clean filter is inserted in the gas preconditioner!

Only turn the Dräger FG4200 on, if the flue gas probe is located in fresh air. The null signals of the sensors are matched with the fresh air.

3.1.2 Prior to each measurement

The air-tightness of the gas path can be tested easily: Close the gas inlet of the probe with the round cap. If the gas path is not leaking, the pump should now deliver more power. The sound of the pump changes accordingly. If no change occurs, then the gas path must be checked with a gas flow meter.

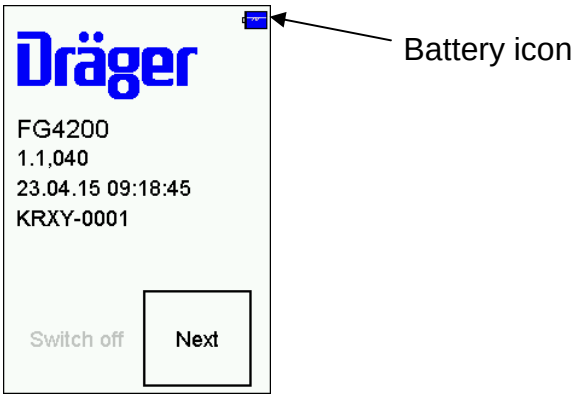
3.1.3 Touch screen

The Dräger FG4200 is controlled by a touch-sensitive display (touch screen). You can execute typing and scrolling functions on the screen using your finger or a plastic pen. Ballpoint pens, pencils, metal pins, etc. are not suitable.
Because the display contains a resistive touch screen, slightly more pressure must be applied during operation compared with today's smartphones with their capacitive touch screens.
Menus and lists can be moved up and down by up/down swiping gestures (scrolling).
Menus and lists positions are highlighted by tapping. The selected item is activated via the **selection** button or by tapping again.

Touching the display with sharp or pointed objects may lead to the destruction of the display.

3.2 Switching on / off

Switch on: Approx. Press the display lightly for 1 second, until the display is illuminated.



The home screen shows the device type, the software version, date and time and the device number. The battery icon displays the charge level of the battery.
The **Next** button switches to the main menu. If the button is not pressed within 5 seconds after switching on, the device switches off automatically. Afterwards the Dräger FG4200 checks its functions with a system check. If scheduled maintenance is pending, the device issues a reminder one month prior to the date of scheduled maintenance.

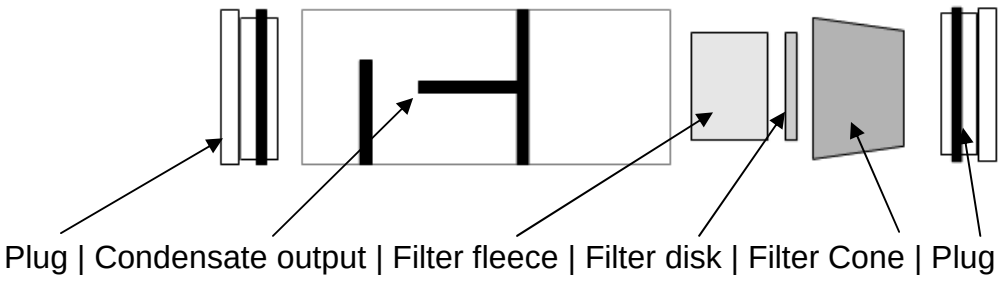
The Dräger FG4200 requires about 30 seconds from switching on until full readiness for operation.

Switching off: Select and activate the **OFF** menu item in the main menu or press the display for 5 seconds whilst in any menu point.

3.2.1 After each measurement

After the measurement, remove the probe from the flue gas flow and let it suck up fresh air for 1-2 minutes, then switch off the appliance. Empty and clean the gas preconditioner. To open the gas preconditioner, remove the two plugs by hand. The filters and the filter fleece must be checked for contamination and replaced if necessary.

Gas preconditioner

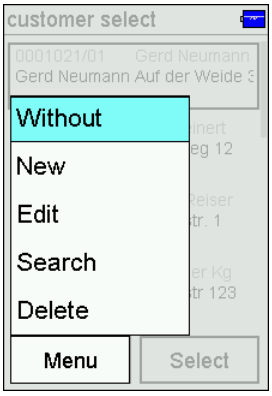


3.3 Control panels

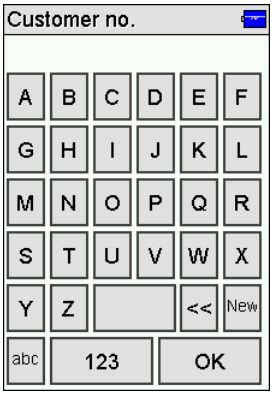
Menu	= opens the context menu for the selection and editing of system data
Select	= enables the marked position
OK	= confirms a selection
Finish	= leads to the next step of function after an action
Next	= leads to the next step of a function
Cancel	= ends a function, switches to the main menu
>>	= scrolls forwards, display switches to chart
<<	= scrolls backwards, display switches to statistical data
Null	= readjusts the zero point of the pressure sensor
Start	= starts the measurement
Stop	= stops the measurement
New	= prepares a new measurement
Docu	= switches to the documentation menu
Back	= switches to the results display from the documentation menu
Customer	= switches from the documentation menu to site selection
Print	= prints the measurement result of the IR transmitter
Save	= saves the measuring result in data memory
End	= switches from the documentation menu to the main menu
Input	= opens the input option for printer text

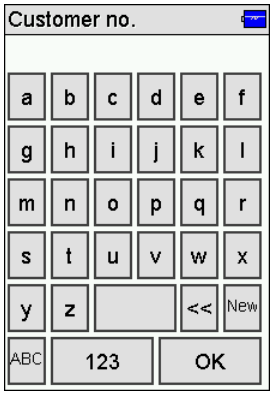
3.4 Customer and site management

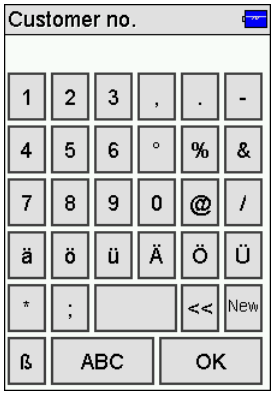
The **Menu** button opens a shortcut menu. Used together with the menu item, the context menu provides different processing options and commands.



Customer data and comments can be entered via an on-screen keyboard.





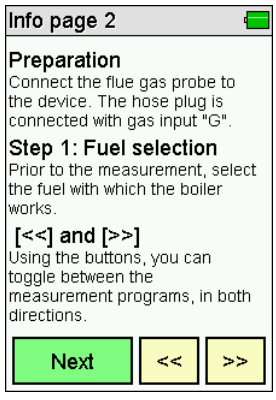


3.5 Integrated operating instructions

In the **Settings** menu item, integrated operating instructions can be activated. When operating instructions are switched on, the corresponding instructions are shown when starting a function.

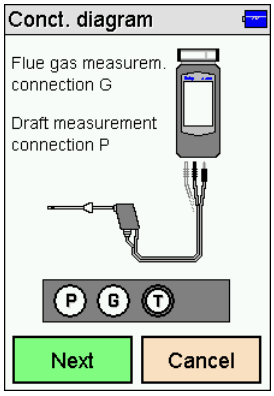
Scroll between pages with **>>** and **<<**.

The measurement program is started with the **Next** button.

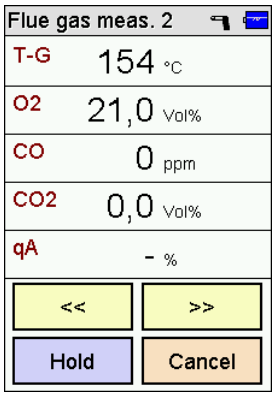

Info page 2
Preparation
Connect the flue gas probe to the device. The hose plug is connected with gas input "G".
Step 1: Fuel selection
Prior to the measurement, select the fuel with which the boiler works.
[<<] and [>>]
Using the buttons, you can toggle between the measurement programs, in both directions.
Next
<<
>>

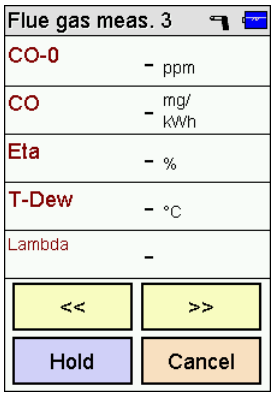
3.6 Starting measurements

Before starting a measurement, the connection used for the measurement is indicated.



3.7 Displaying results

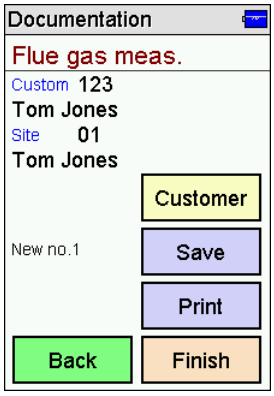




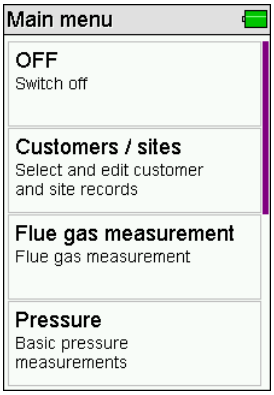
A result display appears after completing a measurement.

3.8 Documentation menu

After completing the measurement, the documentation menu can be opened.
If no customer was selected prior to measurement, a customer can be selected or created here.
The measurement result is assigned to the customer via **Save**.
If no customer is selected, the measurement result is just saved with date and time.
Pressing **Print** allows the measurement result to be sent via the integrated IR transmitter to an infrared printer.



4. Main menu



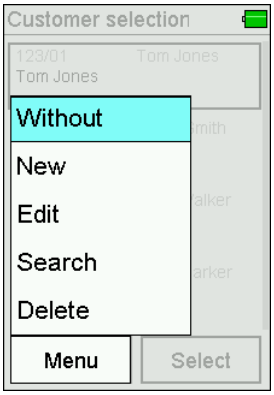
Selectable menu items are:

OFF:	Switch off the measuring device
Customers / sites:	Select and edit customer / site records
Flue gas measurement:	Flue gas analyses with selectable parameters
Pressure:	Basic pressure measurement
Checklists:	Select, edit and save checklists
Data memory:	Data memory information, stored measurements, and inspector table
Info:	Device information
Settings:	Change device and measurement settings, set clock

5. Selecting and entering customer data

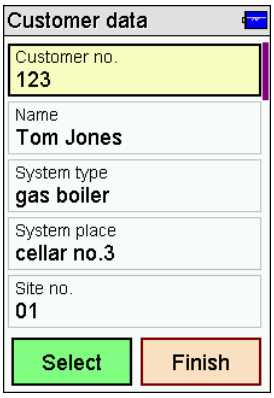
Customers and site records can be created and edited. Completed measurements can then be saved under the set-up customers and sites. Via a link in the documentation menu, customers and sites can be created after the measurement.
In addition, it is also possible to create customer and site records with the software and to transfer data to the device.

Select:	The displayed customer number is transferred.
Menu:	The context menu is opened.



Without:	Measurements are saved without site link.
New:	New customer data can be created.
Edit:	You can edit existing records.
Search:	You can search for a string.
Delete:	You can delete the selected record. That is only possible, if no measurement data is saved in the device.

The following can be stored: customer number, name, system type, system place, site number, street, post code, city, customer name, customer street, customer post code, customer city, customer phone number, boiler manufacturer, boiler type and year of manufacture, boiler output, burner manufacturer, burner type and year of manufacture, burner design and fuel.



The acquired customer number applies to all subsequent measurements until it is switched off or another number is selected.

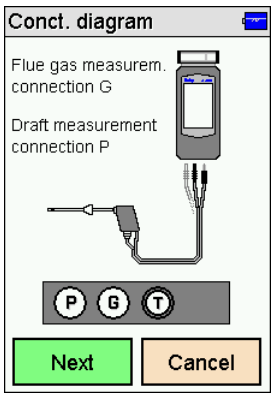
6. Flue gas measurement

To perform a complete flue gas measurement, we recommend a measurement time of at least 2 minutes.

The gas outlet at the side of the device must be free and must not closed or clogged!

6.1 Connecting the flue gas probe

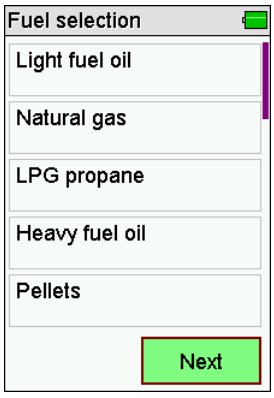
Turn the Dräger FG4200 on and press **Next**.
After the system check, the Dräger FG4200 is ready for use. Select **Flue gas measurement** in the main menu.



Connect the flue gas probe to the device (see connection diagram).
Plug the jack plug of the flue gas probe in the temperature input **T** and the quick-release coupling of the flue gas probe hose into the gas input **G** of the measuring device. Then press **Next**.

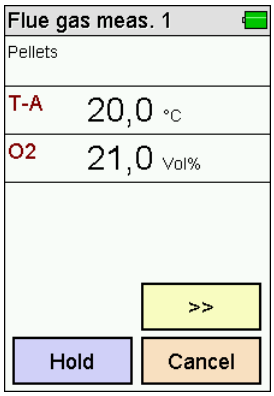
6.2 Selecting fuels

Select the desired fuel and accept.



If the pump was shut off before selection of flue gas measurement function, a short stabilization phase will be performed.

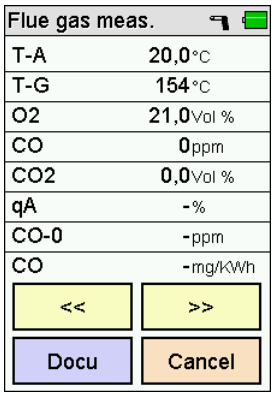
6.3 Measuring combustion air temperature



The Dräger FG4200 will now ask you to measure the combustion air temperature. Place the flue gas probe in the inspection opening of the combustion air intake or alternatively hold the flue gas probe in the room air.

As soon as the combustion air values have stabilized, press **Hold**. If an oxygen content of less than 21% is measured in the combustion air supply, this implies under circumstances a leak in the exhaust pipe in the air-exhaust system.

6.4 Flue gas measurement

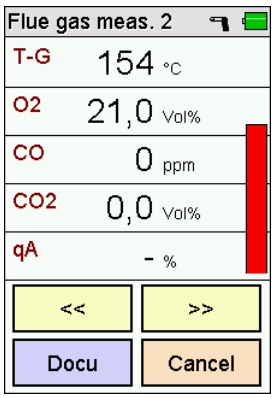


Within the exhaust stream, there are areas which only partially mixed with exhaust. For this reason, it is necessary to take the sample from the flow centre. The flow centre is characterized by maximum flue gas temperature and minimum oxygen concentration.

Press the arrow button >>, once the combustion air measurement is complete.

Now insert the flue gas probe into the exhaust pipe, move it in the exhaust stream and position it so that the tip of the sensor is the flow centre (maximum gas temperature, minimum oxygen concentration). After you've found the flow centre and the measurement values have stabilized, fix the flue gas probe in this optimal position with the sensor cone. A summary of currently measured combustion values is then displayed. Then press the **Hold** button and then the arrow button **>>**. By pressing the arrow button **>>** again, you can display the other measurement results.

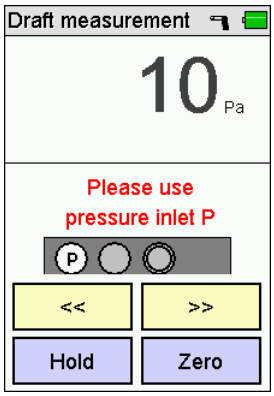
6.5 Average value measurement



The German regulation 1st BImSchV calls for simultaneous determination of oxygen content and temperature of flue gas as an average over a time period of 30 seconds. If **average** measurement is enabled in the settings, you can begin the 30-second averaging process by pressing **Start**, no need to press **Hold**.

6.6 Draft measurement

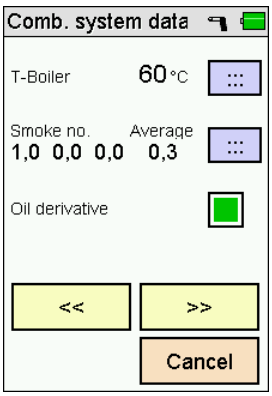
If **draft measurement** is enabled in the settings, the draft (differential pressure) of the flue gas can be measured. This requires moving the flue gas probe from gas inlet **G** to pressure connection **P**.



6.7 Entering combustion system data

If the input of combustion system date has been enabled in the device settings, the boiler temperature, the smoke numbers and the appearance of oil derivatives can be entered. It is only necessary to enter smoke numbers and oil derivatives in case of combustion with fuel oils (light fuel oil and heavy fuel oil) and are only available for measurements with these fuels. Once the input data is complete, press the arrow button **>>**.

The result summary is then displayed and can be scrolled through using the arrow buttons **<<** / **>>**.



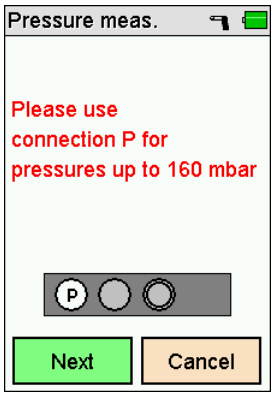
6.8 List of display values

T-A	Combustion air temperature
T-G	Flue gas temperature
O_2	Measured oxygen
CO	Measured carbon monoxide
CO_2	Measured carbon dioxide
qA	Determined flue gas loss of flue gas
CO-0	Determined carbon monoxide content relative to 0 vol. % oxygen
Eta	Determined combustion-technical combustion efficiency
T-Dew	Determined temperature of the dew point
Lambda	Determined combustion air ratio
Draft	Measured induced draft
T-boiler	Entered boiler temperature
O_2-A	Measured oxygen content of combustion air
Smoke no.	Average of the entered smoke numbers
Oil derivative	Consideration of oil derivatives

7. Pressure measurements

7.1 Connection diagram

For pressure measurement up to 160 mbar (gas, nozzle or kinetic pressure), connect the measuring point using the burner pressure hose with the pressure input P of the measuring device.

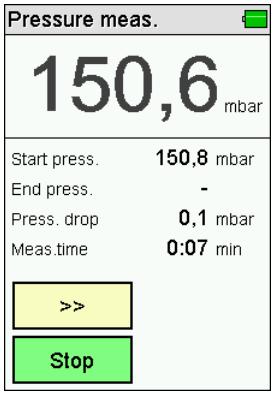


7.2 Pressure measurement

Selectable functions are:

Zero:	the displayed value is set to zero
>> / <<:	Switching between statistics and chart
Start:	Start the pressure measurement
Cancel:	Cancellation of the pressure measurement

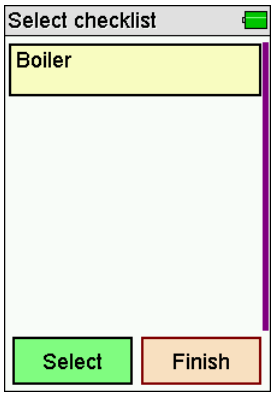
To begin press the **Start** button, according to desired duration with **Stop** to stop the measurement.
After starting the pressure measurement, the current pressure, the starting pressure, the difference between the starting pressure and the previous measurement duration are displayed. The final pressure is displayed, if the measurement is suspended. During the measurement, you can switch to the graph view with the arrow button **>>.**

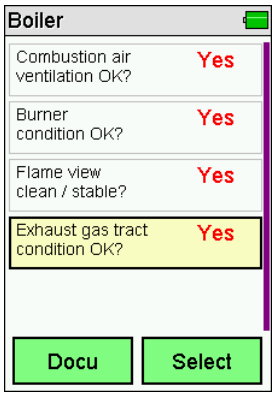


After completing the pressure measurement, the result is displayed.

8. Checklists

Measurement specifications often include visual inspections and other controls that have nothing to do with the actual measurement. Such additional information regarding the measurements or the equipment can be recorded with checklists. Even work instructions can be created and processed in this manner.



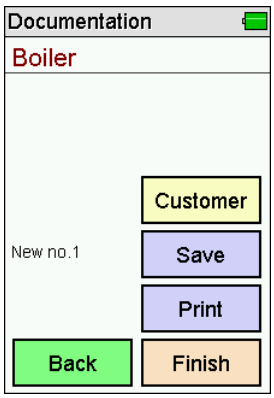


Up to 4 checklists with maximum 20 entries can be created using the PC data management. Each entry can be created so that it can be answered with Yes / No, or with a max. 5 characters long input. If no input has been provided, the entry is represented with ---.

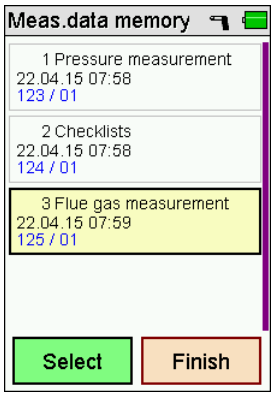
9. Data memory

9.1 Saving measurements

If no site number was selected prior to measurement, the measurement of a site can be assigned before saving, by pressing **Customer** under the documentation menu.



Without site assignment, the measurement is saved with date and time.
By assigning a site, the site number is displayed in addition.



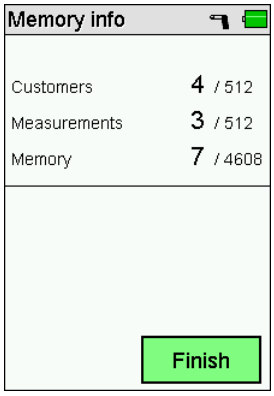
9.2 Data memory functions

Selectable functions are:

Info:	Data storage information
Show data:	Show stored record
Inspectors table:	Viewing and editing the Inspectors table
Delete measurements:	Delete measurement data storage
Delete all customers:	Delete all customer data

9.3 Data storage information

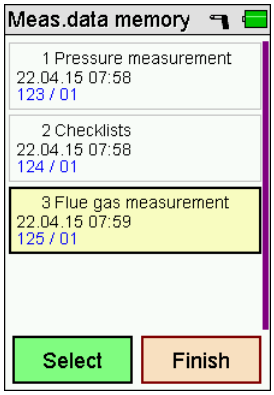
The number of stored customers and measurements, and the total number of occupied memory locations, are displayed in the data storage information.



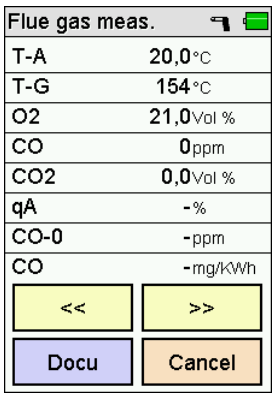
9.4 Show data

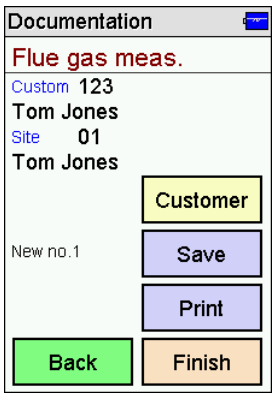
The measurement is saved with date and time and site number, if a site has been assigned.

Select calls up the measurement results display.



With **Docu** the assigned site is displayed and the measurement result can be printed out with site and inspector.



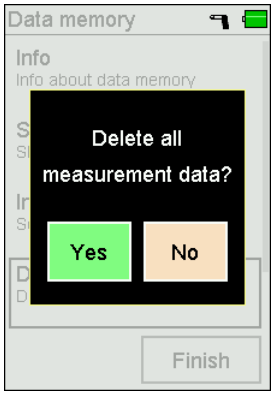


9.5 Inspectors table

In the inspectors table different inspectors can be entered with number, name, street, postcode, town and phone number information. The selected inspector is associated with the stored measurement data. An inspector can only be deleted, if no measurement data is saved in the device.

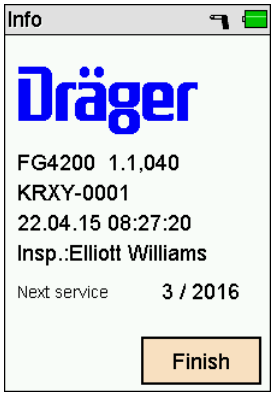
9.6 Deleting measuring data

Deleting measuring data: All measured data are deleted.



10. Device information

This function provides information about the manufacturer (Dräger), the measuring device type (FG4200), the version of the device software (here 1.1,040), the device serial number, the set date, the set time, the selected inspector and the next service date.



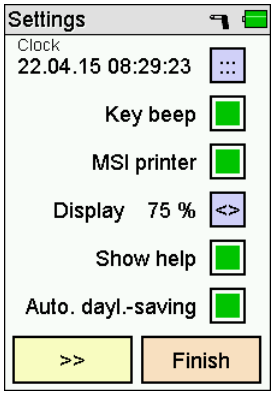
11. Settings

The measuring device can be configured according to user's requirements.

The functions are switched on and off via the control panel or switched to the input.

Settings Page 1

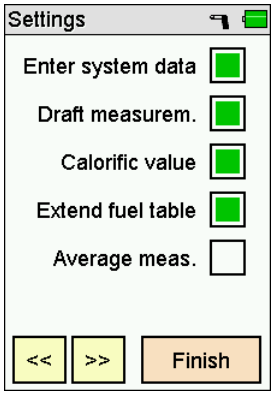
Date and time:	Date and time can be set.
Key beep:	The key beep can be switched on or off.
MSI printer:	The MSI printer protocol can be switched on or off.
Display:	The display lighting can be set.
Show help:	Built-in help texts can be enabled or disabled.
Auto. dayl.-saving:	Automatic adjustment of daylight saving time can be switched on or off.



The arrow button **>>** allows you to switch to the second settings page.

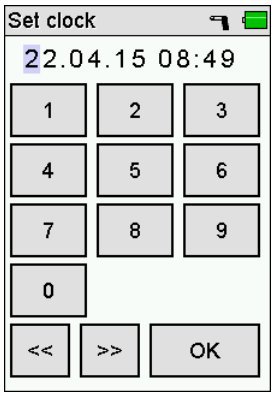
Settings Page 2

Enter system data:	Entering the combustion system data during the flue gas measurement can be switched on or off.
Draft measurem.:	The draft measurement during the flue gas measurement can be switched on or off .
Calorific value:	Switch consideration of calorific value on or off.
Extend fuel table:	Display the extended fuels table.
Average meas.:	Switch average measurement on or off.



Pressing the arrow button **>>** again allows you to switch to entry of a foot text for the IR printer and language configuration.

11.1 Date and time



Setting and changing date and time.
Enter the desired date and time with the numeric keypad. Switch to the changed position with the arrow buttons **<< / >>**.
Confirm the input with **OK**.

11.2 Key beep

This function allows you to turn the key beep on and off.

11.3 MSI printer

This function allows you to switch between the printer logs for MSI printer and HP printers.

MSI IR3 printers: The data transfer and printing rates are faster than HP protocol compatible printers.

HP printers: The data transfer rate corresponds to the HP protocol and is also suitable for all HP protocol compatible printers, and of course for the MSI IR3.

11.4 Display backlight

This function allows you to set the display brightness to 50%, 75% or 100%. The display brightness affects battery life.

11.5 Show integrated operating instructions

This function allows you to turn the integrated operating instructions on and off.

11.6 Automatic daylight saving

This function allows you to turn automatic daylight saving on and off.

11.7 Entering combustion system data

Entry of combustion system data during the flue gas measurement can be switched on or off. This includes taking into account boiler temperature, smoke numbers and oil derivatives.

11.8 Draft measurement

If draft measurement should be considered during flue gas measurement, this can be switched on or off here.

11.9 Calorific value

Enabling takes account of negative qA and ETA values in the measurement. This function should be always active for calorific value systems, so that measurement results are valid.

11.10 Extended fuel table

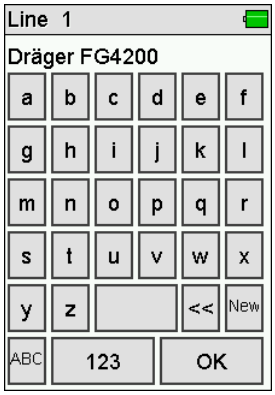
The fuel table, which includes light fuel oil, natural gas, LPG propane, heavy fuel oil and pellets is extended by the following fuels:
wood, brown coal, hard coal, coal briquettes, coal coke, anthracite, biogas, LPG butane, coal gas, coke oven gas

11.11 Average

The 30-second average value measurement according to the German regulation BImSchV during the flue gas measurement can be switched on or off.

11.12 Printer footer texts

With this feature, the printer footer text for the infrared printer can be changed line by line. Pressing OK after entry changes to the next line.

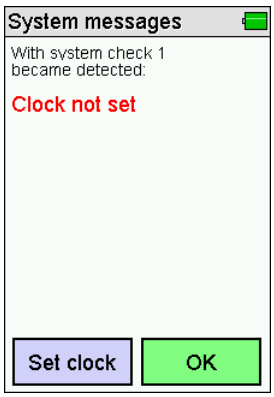


11.13 Language

A country-specific language configuration can be set with this function.

12. Warnings and alarms

In the starting phase and during measurement, the measurement device checks proper function. Warnings and alarms are displayed after the start-up phase or during the normal operation.



Possible displays:

Next service
If a scheduled service is pending, the device issues a reminder one month prior to the date of scheduled maintenance.

Clock not set
Date and time must be set, e.g. after deep-discharging of the battery.

Charge control
The battery must be charged.

Settings
Check settings and change if necessary.

Printer text
An error has occurred in the printer text. Reenter printer text or transfer from the PC.

Data memory
Confirm the question “Reinitialize memory?” This will erase the data memory.

Calibration
An error has occurred in the calibration data. Return device for servicing.

Options
An error has occurred in the options data. Return device for servicing.

Fuel table
An error has occurred in the fuel table. Return device for servicing.

Bluetooth
An error has occurred in the Bluetooth configuration. Return device for servicing.

Pump adjustment
An error has occurred in the pump adjustment. Return device for servicing.

13. Power supply

13.1 General power supply information

A rechargeable lithium ion battery built into the device provides mains-independent operation. The operating time with fully charged battery is up to 8 hours, this can vary depending on the type of measurements and the display brightness set.

13.2 Charging batteries

The charge state of the battery is monitored by the meter and shown in the display. The battery symbol on the display indicates the charge state. The red charging light on the device side flashes in event of a discharged battery. The device should now be charged. Always charge the measuring device fully with a 5 V DC / 1 A USB power supply adapter only. For longer periods of inactivity, we recommend a monthly charge. The USB power adapter supplied with the device is designed to operate at 100 - 240 V AC. For safety reasons, the condition of the power supply should be checked regularly for damage.

The charging process takes 1 - 4 hours, depending on the charge state. During charging, the red LED on the side of the device flashes. The flashing ceases and the LED lights continuously after the charging process is complete. This means that the battery is full and is now powered with a trickle charge current.

If battery charging fails, the device switches off automatically. If the device can no longer be turned on due to low voltage, the USB power adapter must be connected and the device switched on again!

Total discharge of the battery should be avoided, as this may shorten the life of the battery.

14. Technical data

14.1 General technical specifications

Display:	Colour display with touch screen
Interfaces:	USB, IR
Power supply:	Li-ion battery, 3.6 V, 1500 mAh, charge level indicator Primary charger 100 - 240 V AC; Secondary 5 V DC, 1 A
Battery life:	Typical 8 hours
Dimensions:	75 x 200 x 27 mm (W x H x D)
Weight:	approx. 258 g
Operating temperature:	+ 5 °C to + 40 °C
Storage temperature:	- 20 °C to + 50 °C
Relative humidity:	10 - 90 % RH, not condensing
Air pressure:	800 to 1100 hPa
Certification:	DIN EN 50379 Part 1 and Part 3

14.2 Technical specifications for flue gas measurement and pressure measurements

Display	Principle of measurement	Measuring range	Resolution	Accuracy
Combustion air temperature	Thermocouple	- 10 … + 100°C	0.1 °C	< ± 1 °C
Flue gas temperature	Thermocouple	0 … + 600 °C	0.1 °C (< 100 °C) 1 °C (≥ 100 °C)	< ± 2 °C or < ± 1.5 % of MV*
O_2, oxygen	El.-chem. sensor	0 … 25 vol %	0.1 vol %	< ± 0.3 Vol %
CO, carbon monoxide	El.-chem. sensor	0 … 8,000 ppm	1 ppm	0 … 4,000 ppm: < ± 20 ppm or or < ± 5 % of MV*
Draft**	Piezo bridge	- 50 … + 200 Pa	1 Pa	< ± 2 Pa or or < ± 5 % of MV*
Pressure**	Piezo bridge	0 … 100 mbar + 100 … 160 mbar	0.01 mbar 0.1 mbar	0.5 mbar or < ± 1 % of MV* or < ± 5 % of MV*

*MV = Measurement value ** = Pmax. 750 mbar

Calculated values

CO, undiluted	calculated	0 … 9,999 ppm	1 ppm
CO_2, carbon dioxide	calculated	0 … CO_2 max.	0.1 vol %
Flue gas losses	calculated	0 … + 100 % - 20 … + 100 %***	0.1 %
Efficiency	calculated	0 … + 100 % 0 … + 120 %***	0.1 %
Excess air	calculated	1.00 ... 9.99	0.01
CO/CO_2 ratio	calculated	0 … 0.01	0.0001

*** = taking into account of the gain in calorific value

15. Maintenance and care

The measuring device should be checked once a year by an authorized service partner to preserve accuracy and safe function and be adjusted, if necessary.

The device can be cleaned with a damp, not wet, cloth. Do not use any chemical cleaning agents. Make sure that the device connections are not blocked or dirty.

16. Consumables and accessories

5600907	Consumables set incl. 10 filter fleece and 5 filter discs
5600401	IR3 printer with infrared data transmission
5690151	Printing paper for printer
5680124	USB power adapter 100 – 240 VAC
5650831	USB cable, 1 m
5600890	Flue gas probe FG4x00
5610709	Burner pressure hose P4000
5600906	Device bag FG4x00
5610733	Magnetic rubber set

17. Managing PC measuring data

To download the measurement data management go to our website http://www.draeger-msi.de/home/?L=1 under the menu item **Online-Services → Download → FG4200**. The necessary USB drivers are installed automatically.